UPnP AV Architecture:1

For UPnP™ Version 1.0
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1. Introduction

This document describes the overall UPnP AV Architecture, which forms the foundation for the UPnP AV Device and Service templates. The AV Architecture defines the general interaction between UPnP Control Points and UPnP AV devices. It is independent of any particular device type, content format, and transfer protocol. It supports a variety of devices such as TVs, VCRs, CD/DVD players/jukeboxes, settop boxes, stereos systems, MP3 players, still-image cameras, camcorders, electronic picture frames (EPFs), and the PC. The AV Architecture allows devices to support different types of formats for the entertainment content (such as MPEG2, MPEG4, JPEG, MP3, Windows Media Architecture (WMA), bitmaps (BMP), NTSC, PAL, ATSC, etc.) and multiple types of transfer protocols (such as IEC-61883/IEEE-1394, HTTP GET, RTP, HTTP PUT/POST, TCP/IP, etc.). The following sections describe the AV Architecture and how the various UPnP AV devices and services work together to enable various end-user scenarios.

2. Goals

The UPnP AV Architecture was explicitly defined to meet the following goals:

- To support arbitrary transfer protocols and content formats.
- To enable the AV content to flow directly between devices without any intervention from the Control Point.
- To enable Control Points to remain independent of any particular transfer protocol and content format. This allows Control Points to transparently support new protocols and formats.
- Scalability, i.e. support of devices with very low resources, especially memory and processing power as well as full-featured devices.

3. Non-Goals

The UPnP AV Architecture does not enable any of the following:

- Two-way Interactive Communication, such as audio and video conferencing, Internet gaming, etc.
- Access Control, Content Protection, and Digital Rights Management
- Synchronized playback to multiple rendering devices.

4. Overview

In most (non-AV) UPnP scenarios, a Control Point controls the operation of one or more UPnP devices in order to accomplish the desired behavior. Although the Control Point is managing multiple devices, all interactions occur in isolation between the Control Point and each device. The Control Point coordinates the operation of each device to achieve an overall, synchronized, end-user effect. The individual devices do not interact directly with each another. All of the coordination between the devices is performed by the Control Point and not the devices themselves.

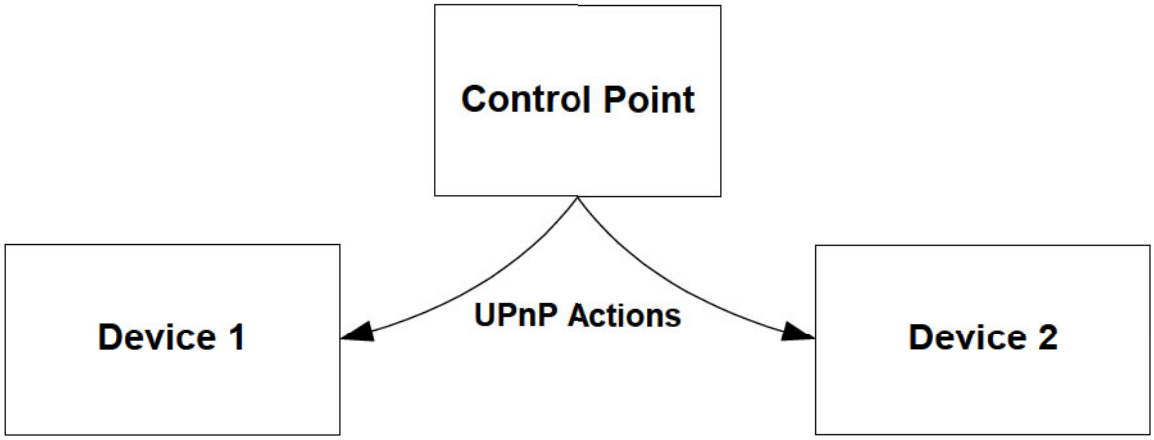

Figure 1: Typical UPnP Device Interaction Model

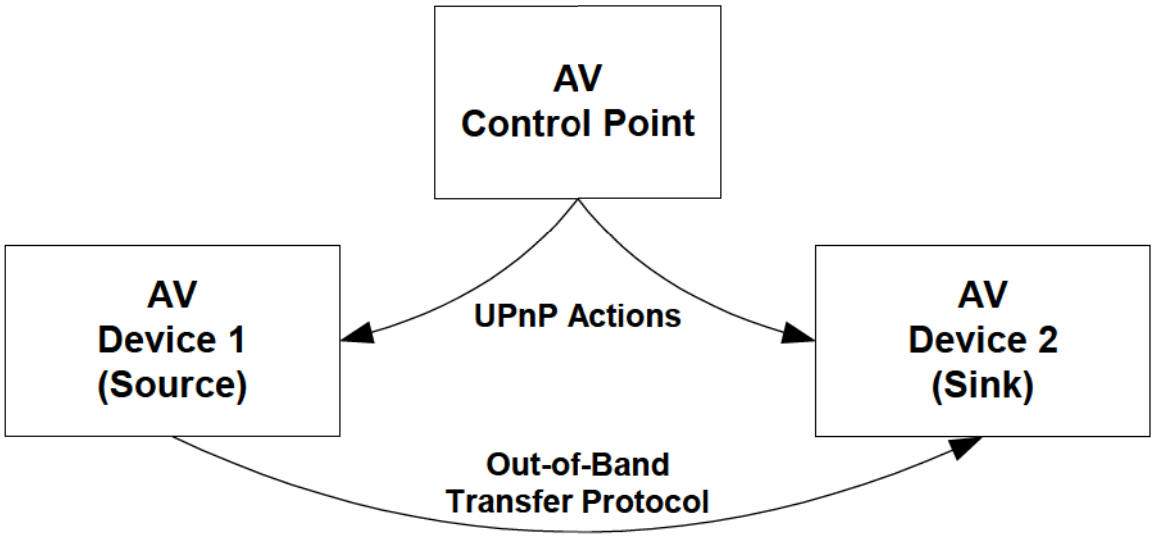

Figure 2: UPnP AV Device Interaction Model

Most AV scenarios involve the flow of (entertainment) content (i.e. a movie, song, picture, etc.) from one device to another. As shown in Figure 2, an AV Control Point interacts with two or more UPnP devices acting as source and sink, respectively. Although the Control Point coordinates and synchronizes the behavior of both devices, the devices themselves interact with each other using a non-UPnP ("out-of-band") communication protocol. The Control Point uses UPnP to initialize and configure both devices so that the desired content is transferred from one device to the other. However, since the content is transferred using an "out-of-band" transfer protocol, the Control Point is not directly involved in the actual transfer of the content. The Control Point configures the devices as needed, triggers the flow of content, then gets out of the way. Thus, after the transfer has begun, the Control Point can be disconnected without disrupting the flow of content. In other words, the core task (i.e. transferring the content) continues to function even without the Control Point present.

As described in the above scenario, three distinct entities are involved: the Control Point, the source of the media content (called the "MediaServer"), and the sink for the content (called the "MediaRenderer"). Throughout the remainder of the document, all three entities are described as if they were independent devices on the network. Although this configuration may be common (i.e. a remote control, a VCR, and a TV), the AV Architecture supports arbitrary combinations of these entities within a single physical device. For example, a TV can be treated as a rendering device (e.g. a display). However, since most TVs contain a built-in tuner, the TV can also act as a server device because it could tune to a particular channel and send that content to a MediaRenderer (e.g. its local display or some remote device such as a tuner-less display). Similarly, many MediaServers and/or MediaRenderers may also include Control Point functionality. For example, an MP3 Renderer will likely have some UI controls (e.g. a small display and some buttons) that allow the user to control the playback of music.

5. Playback Architecture

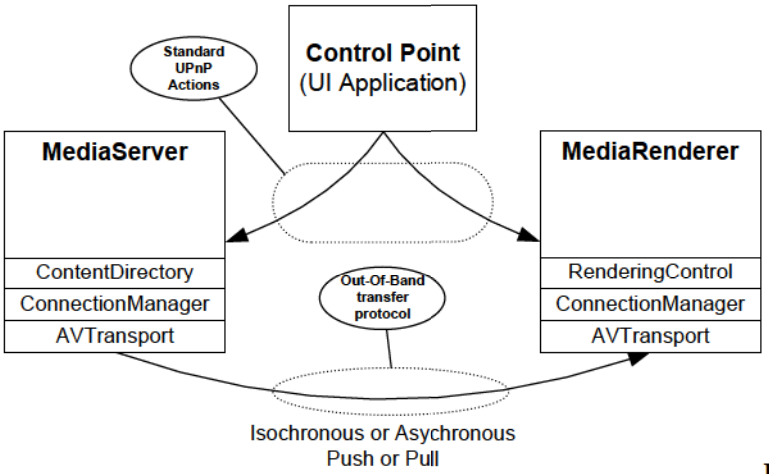

Figure 3

The most common task that end-users want to perform is to render (i.e. play) individual items of content on a specific rendering device. As shown in,

Figure 3, a content playback scenario involves three distinct UPnP components: a MediaServer, a MediaRenderer, and a UPnP Control Point. These three components (each with a well-defined role) work together to accomplish the task. In this scenario, the MediaServer contains (entertainment) content that the user wants to render (e.g. display or listen to) on the MediaRenderer. The user interacts with the Control Point's UI to locate and select the desired content on the MediaServer and to select the target MediaRenderer.

The MediaServer contains or has access to a variety of entertainment content, either stored locally or stored on an external device that is accessible via the MediaServer. The MediaServer is able to access its content and transmit it to another device via the network using some type of transfer protocol. The content exposed by the MediaServer may include arbitrary types of content including video, audio, and/or still images. The content is transmitted over the network using a transfer protocol and data format that is that is understood by the MediaServer and MediaRenderer. MediaServers may support one or multiple transfer protocols and data formats for each content item or be able to convert the format of a given content item into another formats on the fly. Examples of a MediaServer include a VCR, CD/DVD player/jukebox, camera, camcorder, PC, set-top box, satellite receiver, audio tape player, etc.

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